

# AMD Server/Workstation

November 2005

# AMD Today



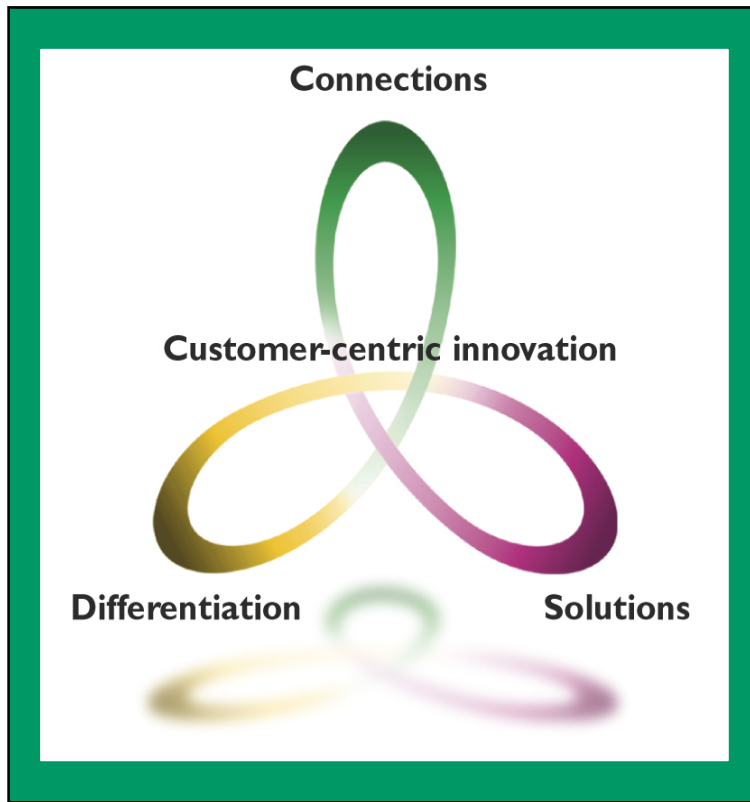
# AMD at a Glance

- Founded in 1969
- Based in Sunnyvale, CA, with manufacturing and sales facilities worldwide
  - Main production facility, new 90 nm Fab in Dresden, Germany
- ~16,000 employees
- Comprehensive product line
  - Solutions for server, desktop, notebook and embedded applications
  - Flash memory
- But not just “chips for chips’ sake”
  - “The era of technology for technology’s sake is behind us. Innovation driven by real customer needs — ‘customer-centric innovation’ — is the new path to leadership.” –Hector Ruiz



# Our Philosophy: Customer-Centric Innovation

Customers are at the center of everything we do



Expand **connections**  
with customers,  
partners and end users

Evolve beyond products  
and technologies to  
**solutions**

Enable meaningful  
customer  
**differentiation** at  
ever-declining costs

# AMD Has Evolved

## *From Follower to Challenger to Leader*

### Follower Pre-1997

- Second source for x86
- 286, 386, 486
- Socket compatible

### Challenger 1997-2002

- Product leadership
- AMD Athlon™, AMD Athlon XP, and AMD Duron™ processors
- Launched model numbers reflecting true performance – Intel's now following!
- DDR Memory
- First to 1GHz
- AMD-specific infrastructure
- Award-winning fab

### Leader 2003 forward

- Architectural leadership with Direct Connect Architecture
- 64-bit processors for the masses – AMD Opteron™ & AMD Athlon 64 processors
- Dual-core architecture
- Linux & Windows® OS for AMD64

# Leading the Industry to Pervasive 64-Bit Computing

## Connections



Welcome to the

World of AMD64

The ranks are growing. **Who's Next?**

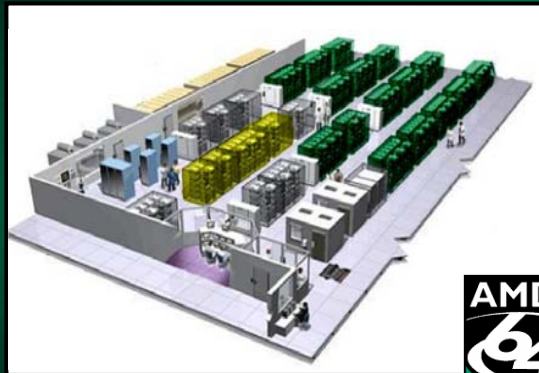
Adopted by more than  
2,000 manufacturers  
and partners worldwide

# AMD Customer-Centric Solutions

## Single Architecture of Business Computing

**AMD64 delivers a single architecture across an IT environment to efficiently fulfill the needs of business computing while allowing a migration to 64-bit computing when your customers are ready.**

**One Enterprise, One Architecture**



# What Customers are saying . . .

"Securing **greater memory utilization** for our Barra 32-bit application by switching to AMD Opteron™ processor-based systems and Microsoft's® public Beta version of Windows® Server 2003, Enterprise Edition for 64-bit Extended Systems, gave us **performance gains without having to recompile a single line of code.**"

-Max Giolitti, Microsoft Treasury 

"We **worked closely with AMD to create the most energy-efficient solution available.** Now that we have replaced our previous processors with the AMD Opteron™ processor, we don't put off nearly the heat so we have conserved energy and saved money by not needing as many cooling systems and solar panels

- Sherry Nail  
Affordable Internet Services Online, Inc. (AISO)

"We first decided to look at the AMD Opteron™ processor in part because it was competitively priced, and our hope was that the processor's performance would be at least as good as that of our existing systems. However, **we were blown away by the performance, finding that it significantly exceeded our expectations.**"

- Craig Murphy, CTO,  
Sabre Holdings



"The AMD Opteron™ processor with AMD64 technology was very compelling for us, because it **allows us to boost the performance of our current 32-bit applications and simultaneously prepare to migrate to 64-bit technology when we are ready.** This is a very alluring aspect of AMD64 technology." .

- Nick Miller, IT Services Manager  
Bell Helicopter, a Textron company



# AMD Server Penetration Strategy



*Growing and Growing, and Growing . . .*

## Technical & Database Computing

## Commercial & Enterprise IT Infrastructure

### HPC

#### Government/Academia

- Research Centers
- National labs
- Universities

#### Commercial Eng'g/Research

- Oil & Gas
- Pharmaceuticals
- Automotive
- Aerospace

#### Commercial Business

- Financial Services
- Retail/Wholesale
- Healthcare

#### Enterprise

- Web & Application Serving
- CRM/ERP
- Collaboration & Messaging
- Virtualization



# Why AMD in 2005?

**AMD has taken a leadership position in the market with customer-centric solutions**

- AMD64 systems architecture
- Broad eco-system support

**AMD Opteron™ processor is leading the Server/Workstation enterprise market**

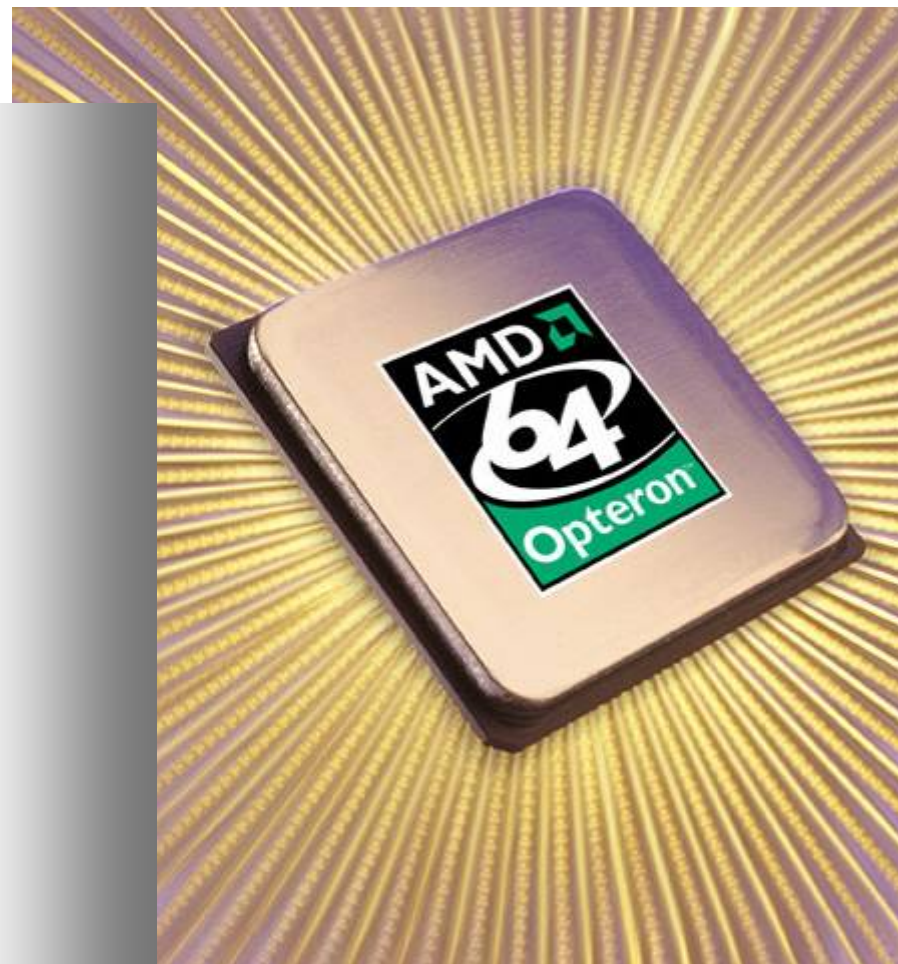
- Enable the world's highest-performing x86 processor for 2P & 4P servers

**Leading enterprise customers are adopting AMD Opteron within mission critical environments**

- Multiple industries have adopted AMD Opteron processors in their mission critical environments

**Leverage AMD Opteron as a key differentiator to drive new business**

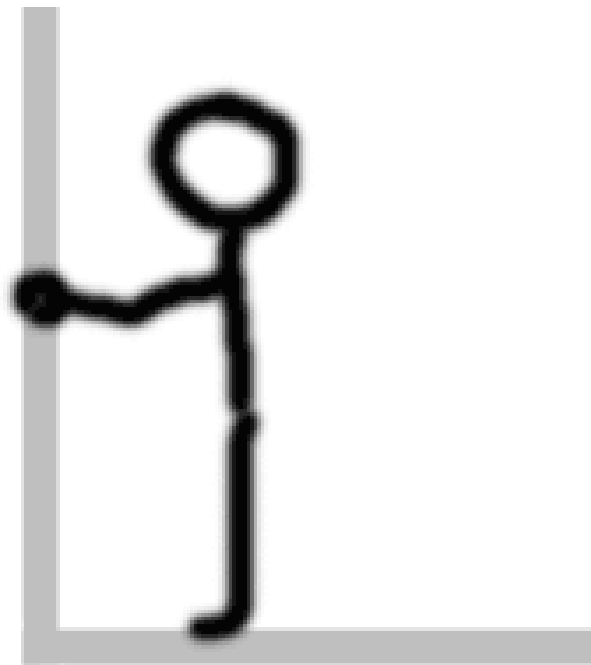
- In a sea of "me too" products, differentiate with an innovative system architecture



# AMD Opteron™ Processor and Direct Connect Architecture



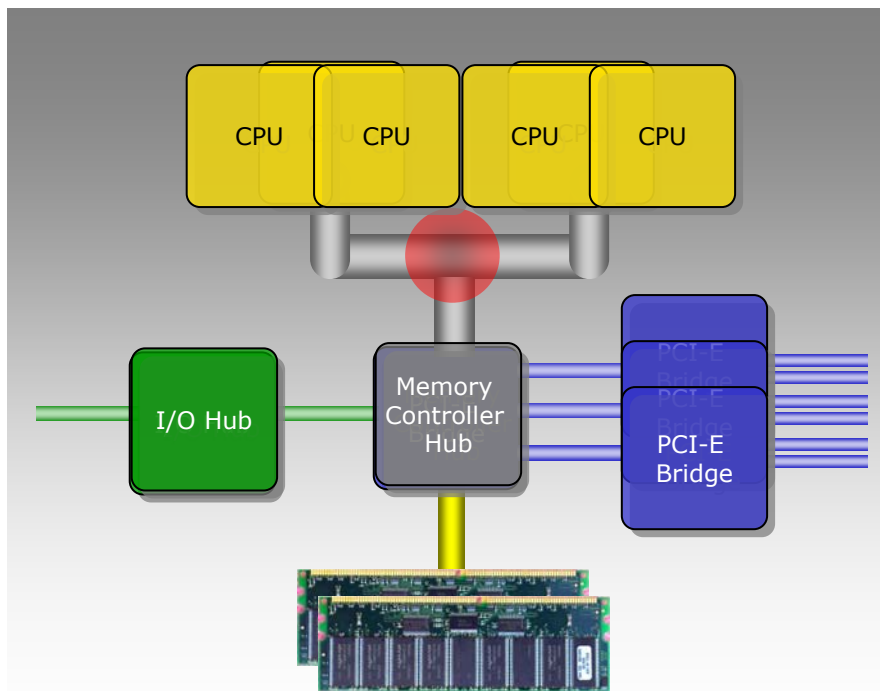
# What's the Point?



It's about the  
architecture.

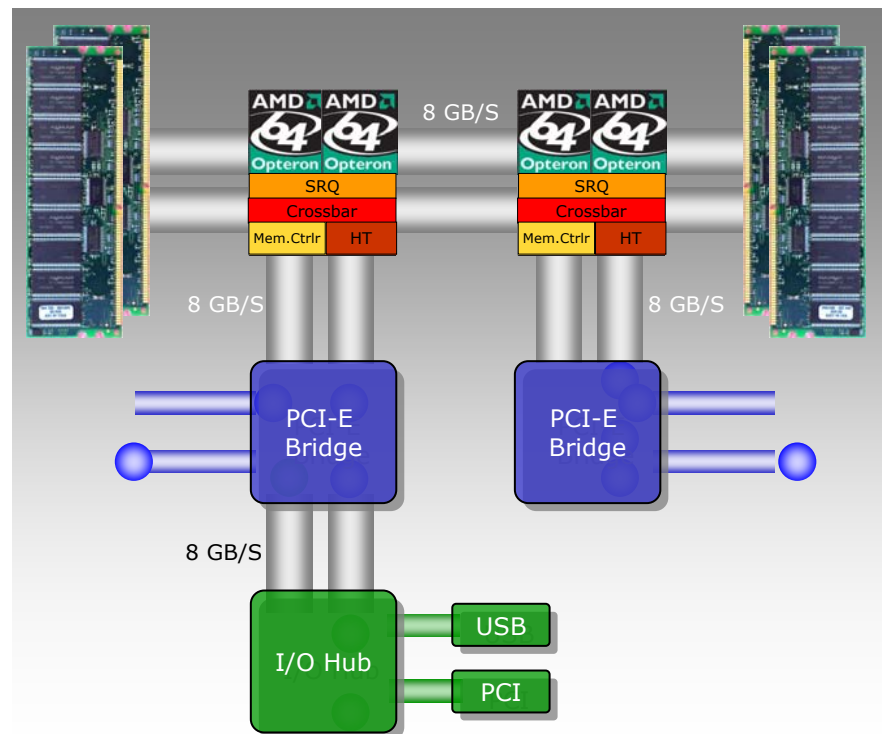
**"Providing Balanced Platform Bandwidth"**

# Eliminating Architectural Bottlenecks



## Legacy x86 Architecture

- 20-year old front-side bus architecture
- CPUs, Memory, I/O all share a bus
- Major bottleneck to performance
- Faster CPUs or more cores  $\neq$  performance



## AMD64 Technology with Direct Connect Architecture

- Industry-standard AMD64 technology
- AMD's revolutionary Direct Connect Architecture eliminates FSB bottleneck
- HyperTransport™ Technology interconnect for high bandwidth and low latency

# AMD Opteron™ Processor Overview

## ➤ **Outstanding Performance**

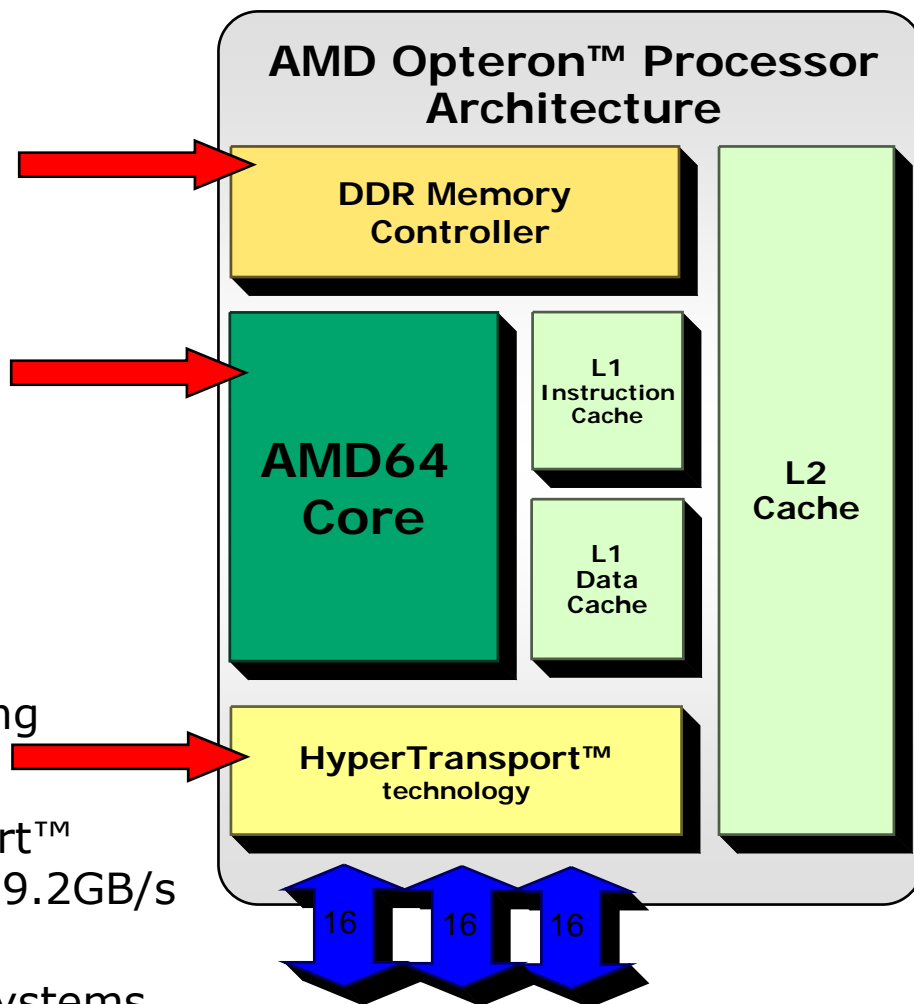
- ✓ High-bandwidth integrated memory controller scales with processor frequency and number of processors

## ➤ **64-bit Architecture with 32-bit Compatibility**

- ✓ Approximately 10,000 legacy applications at time of launch

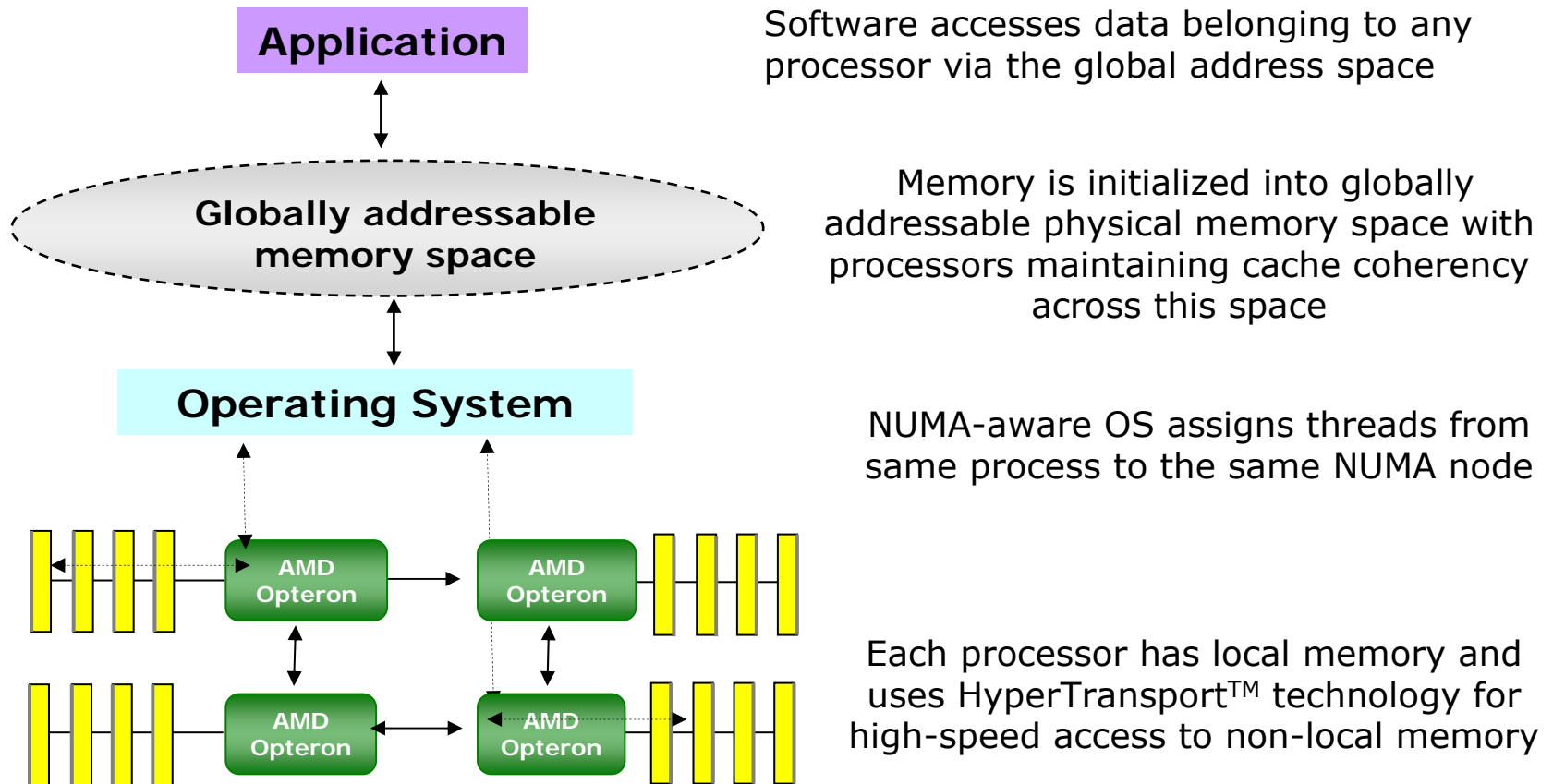
## ➤ **Exceptional Scalability**

- ✓ Glueless multiprocessor scaling
- ✓ Removes I/O bottlenecks
  - Three 16-bit HyperTransport™ technology links provides 19.2GB/s peak aggregate bandwidth
- ✓ Reduced costs for high-end systems



# NUMA Architecture (Non-Uniform Memory Access)

**Provides applications with performance and scalability**





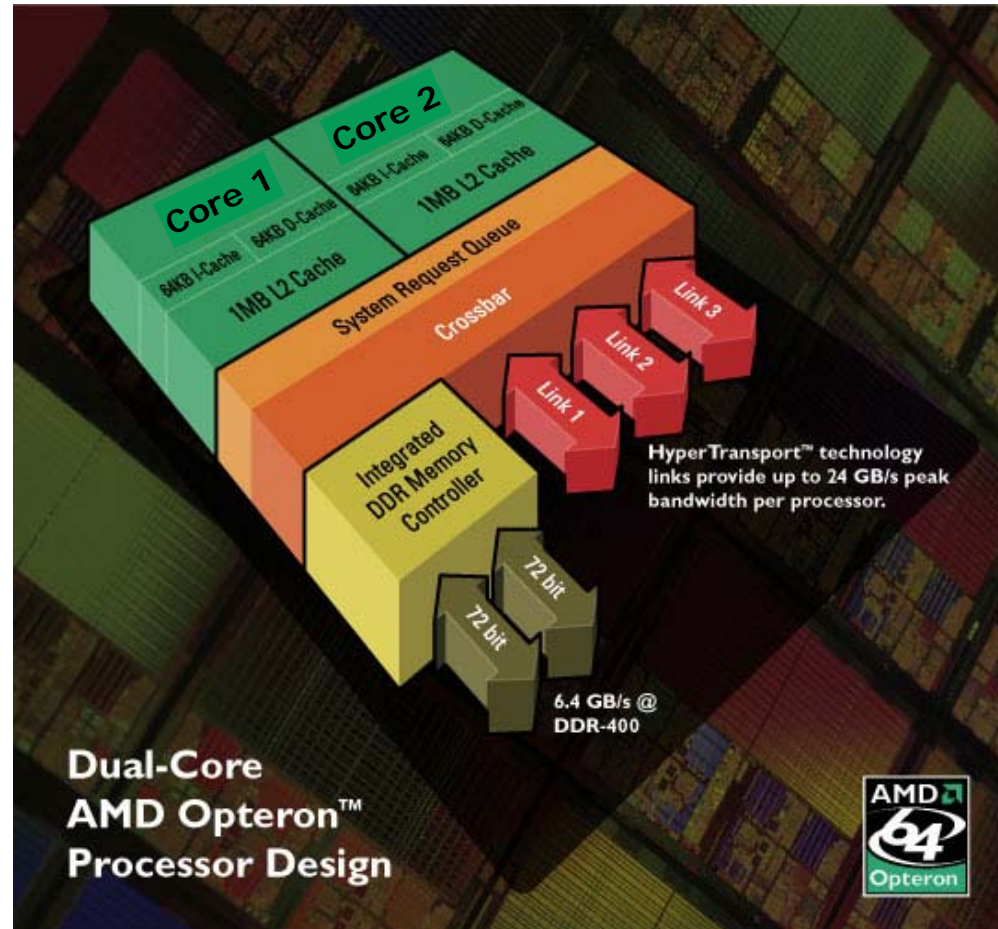
# Dual-Core

AMD64 Designed for Dual Core

Socket Compatible with  
current 940 or 939 solutions

No Changes in Power

Non-disruptive migration



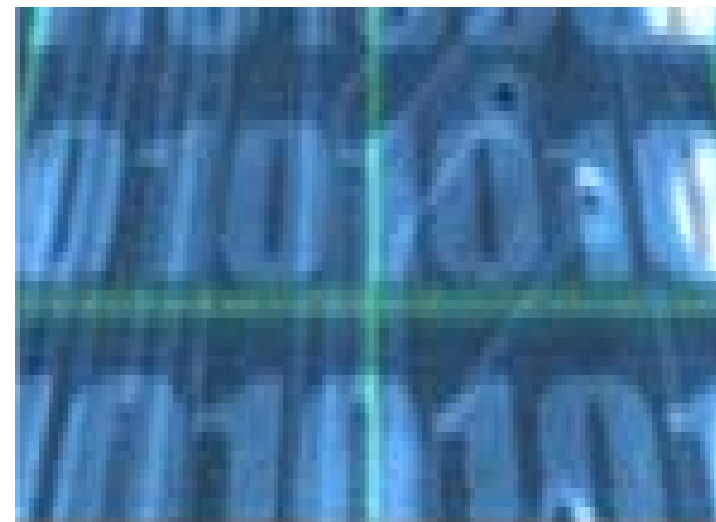
Differentiation

AMD



# Dual-Core Application Benefits

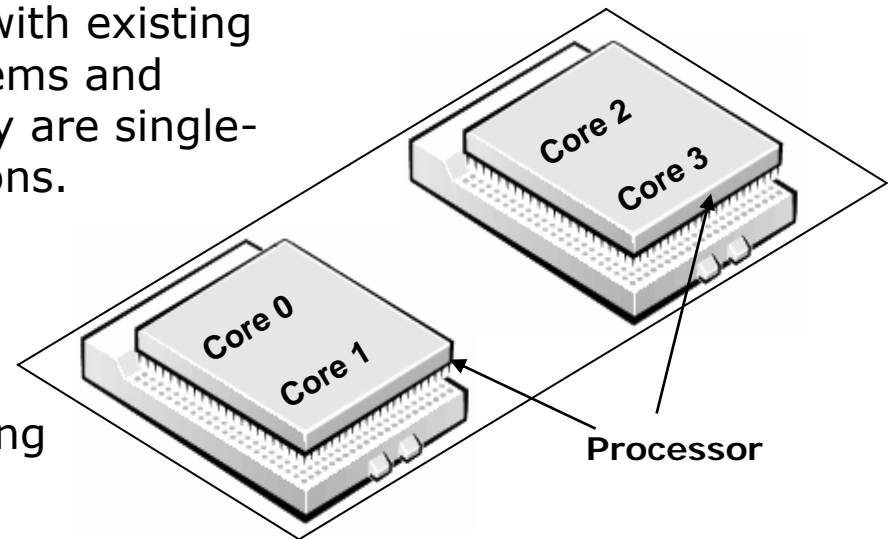
- **Improved system efficiency and application performance for computers running multiple applications**, including consumer, commercial desktop and mobile systems and multi-purpose servers
- **Enhanced performance for multi-threaded applications**
- **Support for more users or tasks for transaction intensive applications** such as Web and application servers
- Superior performance for **compute-intensive applications** such as financial analysis and scientific simulations
- **Reduced infrastructure requirements while eliminating heat and wattage penalties** and offering superior performance



# Dual Core and Software Licensing

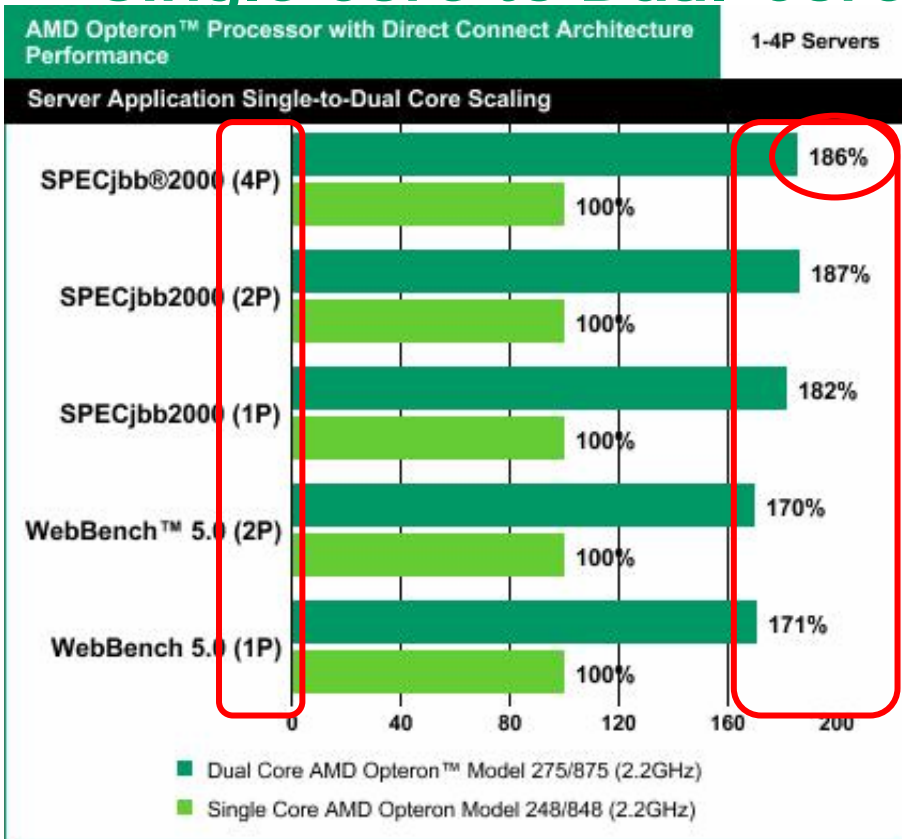
**For the initial AMD64 dual core product releases in April 2005, AMD took a leadership position in recommending that ISVs license by processor instead of by processor core.**

- Only applies to software licensing methods that rely on processor count - there are many software licensing models that do not count processors today
- Helps ensure software compatibility with existing x86 32-bit and 64-bit operating systems and applications seamlessly whether they are single-threaded or multi-threaded applications.
- Meets the requirements of our customers
- AMD will continue competitive single core parts to meet customer's licensing needs for certain applications



# Dual-Core AMD Opteron™ Processor Performance

## Single Core to Dual-Core Scaling



- Dual-Core Model 275/875 provides up to **86% more performance** than Single-Core Model 248/848 **at the same 2.2 GHz frequencies**
- 70%+ gains across the board, from 1P to 4P benchmarks (at same frequencies and power consumptions!)

Configuration information available on [http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_8800~97051,00.html](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_8800~97051,00.html)

For additional server benchmark information, please visit [http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_8800,00.html](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_8800,00.html)

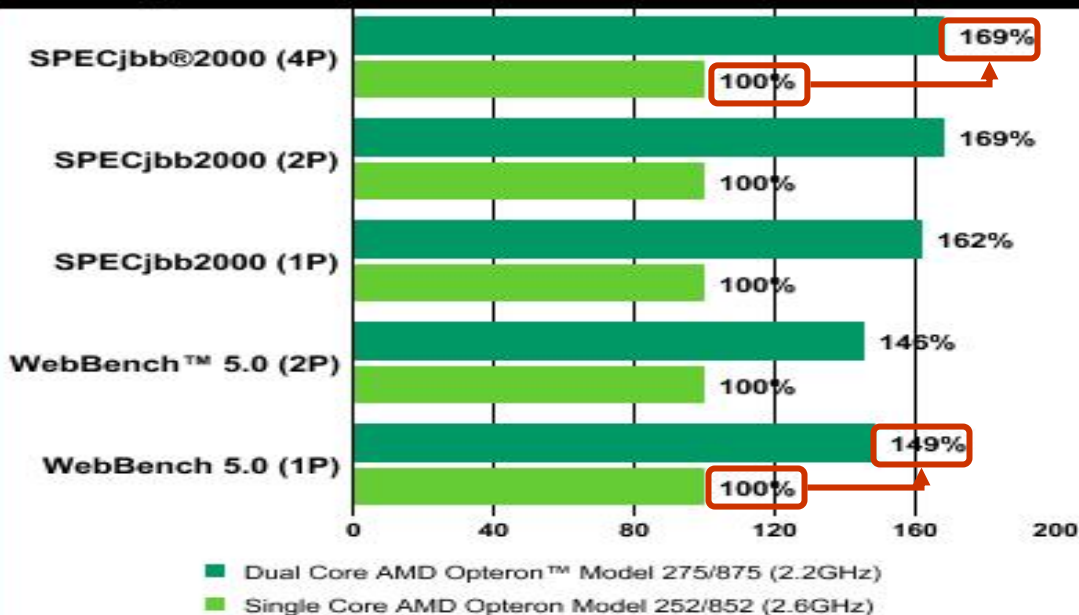
# Dual-Core AMD Opteron™ Processor Performance

## Single Core to Dual Core Performance Gain

AMD Opteron™ Processor with Direct Connect Architecture Performance

1-4P Servers

Server Application Single-to-Dual Core Performance Gain



SPEC and the benchmark name SPECjbb are registered trademarks of the Standard Performance Evaluation Corporation. SPEC score for AMD Opteron processor Model 875 and 275-based systems are under submission to SPEC as of April 18, 2005. Other competitive results stated above reflect results published on www.spec.org as of April 5, 2005. For latest SPECjbb2000 results visit <http://www.spec.org/jbb2000>.

Dual-Core Model 275/875 provides up to **69% more performance** than fastest Single-Core Model 252/852

Configuration information available on [http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_8800~97052,00.html](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_8800~97052,00.html)



# AMD Dual-Core Value Proposition

- **Direct Connect Architecture**

- Fastest core-to-core communications  
No Bottlenecks

- **Best upgrade story in the industry**

- BIOS change only  
Use your existing 90nm infrastructure

- **Best Performance per Watt**

- Dual-core performance boost in same power envelope

- **Best Performance per Footprint**

- Dual-core performance boost in existing enclosures  
Critical in a rack-dense environment

- **Stable infrastructure**

- Same high-performance socket & infrastructure across all 90nm AMD Opteron™ processors

- **Strong Partner Support**

- Leading systems manufacturers & software vendors support AMD64 Dual-Core technology

- **Execution of strategy**

- First to market with X86 Dual-Core product



For more information, please visit  
<http://multicore.amd.com/Global/>

Differentiation



# **AMD Opteron™ Processor Power Advantage**



## AMD PowerNow!<sup>TM</sup> Technology

- Enables the CPU to optimize power by dynamically switching among multiple performance states (frequency & voltage combinations) based on CPU utilization, without having to reset CPU.
- Lowers power consumption without compromising performance
- Strengthens the AMD Opteron<sup>TM</sup> processor performance-per-watt capabilities

## Proven AMD technology

- Introduced in June 2000 with mobile AMD K6<sup>®</sup> -2+ and AMD K6-III+ processors

*AMD was the first to introduce dynamic (multiple operating states) power management solution*

## Planned support for Microsoft and Linux operating systems

Delivers performance on demand minimizing power when full CPU performance is not necessary

For additional information, please visit [www.amd.com/us-en/0,,3715\\_12353,00.html](http://www.amd.com/us-en/0,,3715_12353,00.html)

# AMD Opteron™ Processor

## *Less Power and Less Heat than Xeon*

From HP's Power Calculator:

<http://h30099.www3.hp.com/configurator/calc/Power%20Calculator%20Catalog.xls>



HP ProLiant DL 145  
2P AMD Opteron™  
processor-based

220V input, 2 CPU, 4GB RAM, 2 HD,  
1PCI card

**309W, 1052 BTU/hr**



HP ProLiant DL 140  
2P Xeon  
processor-based

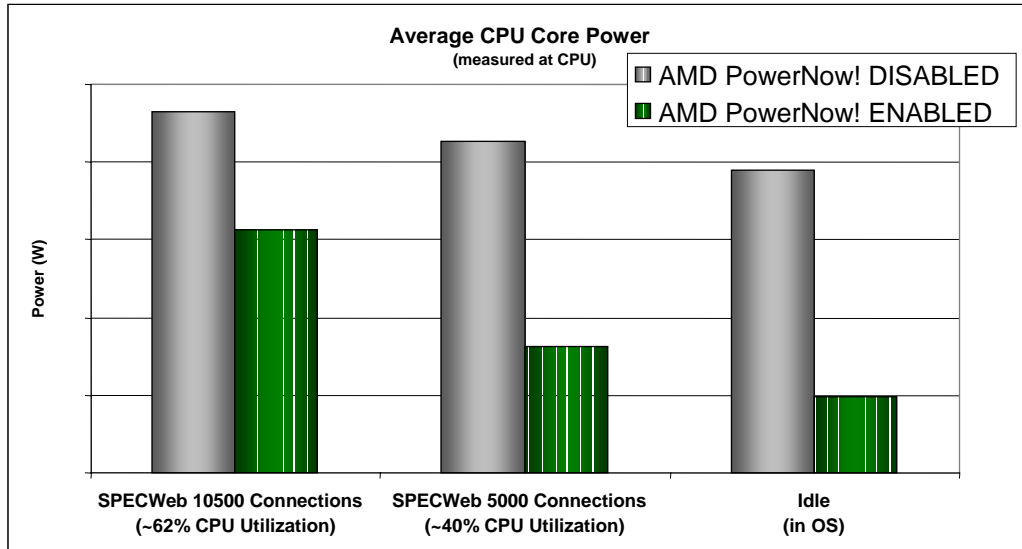
220V input, 2 CPU, 4GB RAM, 2 HD,  
1PCI card

**389W, 1326 BTU/hr**

***AMD Opteron processor-based system:  
Uses ~21% less power!***



# AMD PowerNow!™ Power Savings Model



CPU Utilization	Power Savings	1-Year Power Savings	3-Year Power Savings
62%	33%	\$25K	\$74K
40%	62%	\$46K	\$139K

Example assumes:  
128 node 2P system installation  
\$0.10/KWH energy cost, 3.5x data center overhead factor

- AMD PowerNow! is available with all AMD Opteron™ processors
- Enables substantial energy savings with no sacrifice in performance
- Savings continue to multiply with increasing installation size

# Low-Power AMD Opteron™ Processors

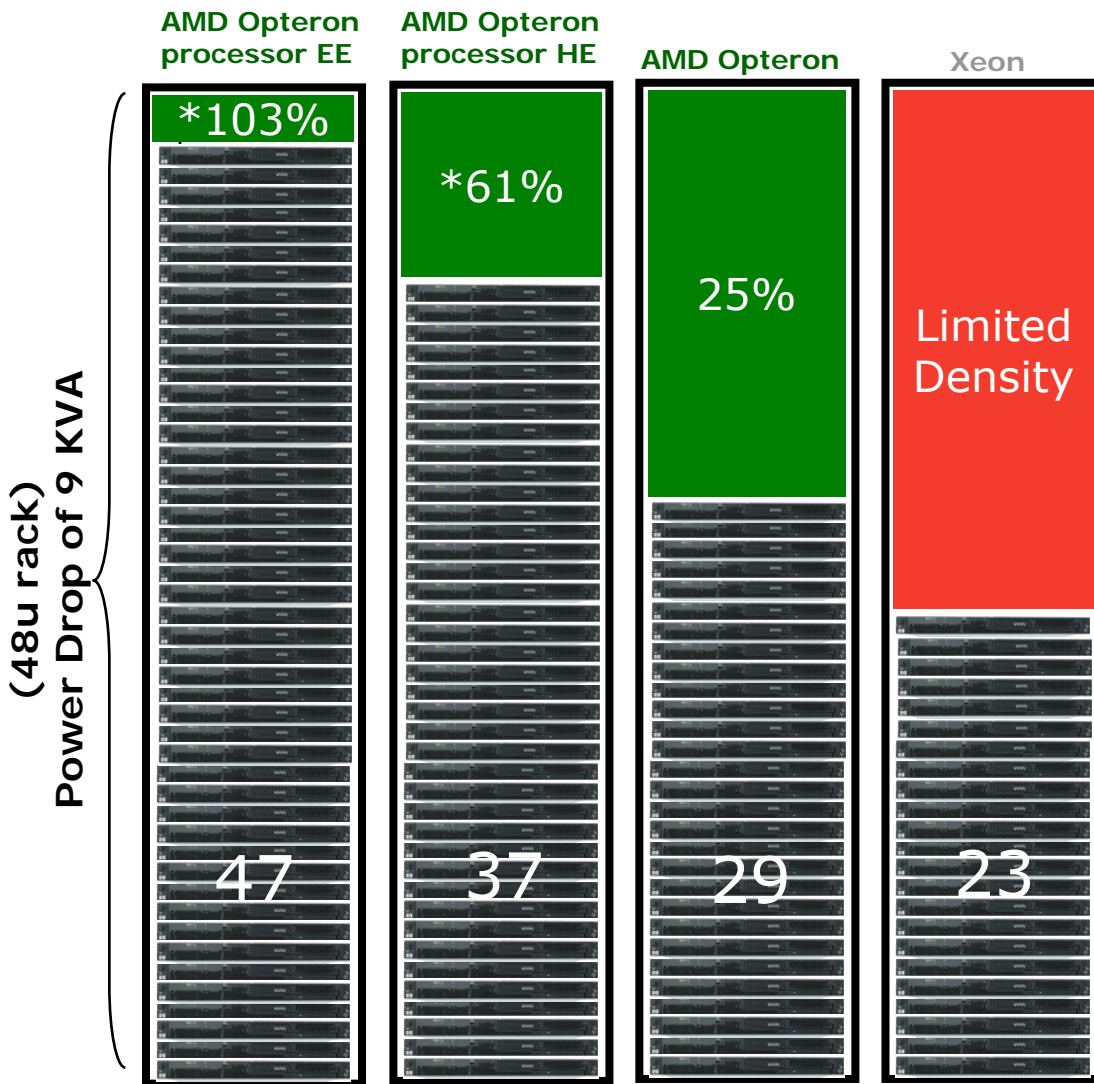
## **55 watt AMD Opteron™ processors targeted at:**

- Rack-dense servers
- Blade enclosures

- These lower wattage processors are expected to enable platforms that must conform to specific lower power requirements.
- One architecture for all AMD Opteron™ processor implementations
- 89W and 55W both leverage existing 940-pin infrastructure
  - Layout design, thermal solutions, software, etc.
- AMD Opteron processors 100 Series, 200 Series and 800 Series parts available in all power levels
- There is no performance penalty when using a lower power part.
  - A 55 watt 146 series part will perform exactly like a full-power 146 part

# AMD Opteron™ Processor Power Advantage

## *Increasing Density without Facilities Upgrades*



Datacenter space is extremely expensive!

- Cost of Power
  - Cost of Cooling
  - Cost of Space
- 
- AMD Opteron processor-based solutions provide more density within a given power budget over Xeon processor based solutions
    - AMD Opteron provides 25% more than Xeon*
    - AMD Opteron processor HE provides 61% more than Xeon*
    - AMD Opteron processor EE provides 103% more than Xeon*
  - AMD Opteron processor family offers flexibility
    - AMD Opteron HE and EE for ultra power constrained environments*

\* Estimates using HP DL140 & DL145 power input and BTU generated as baseline

HP Power Calculator:

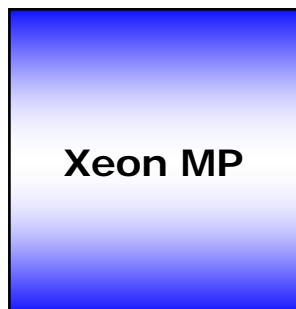
<http://h30099.www3.hp.com/configurator/calc/Power%20Calculator%20Catalog.xls>

Note: The 2P/1U form factor not applicable in all cases, specific cases shown for demonstration purposes only

# AMD Opteron™ Processor Roadmap

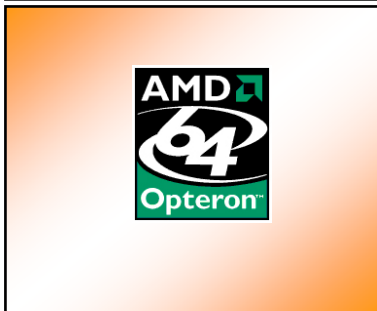


# Server/WS Processor Positioning



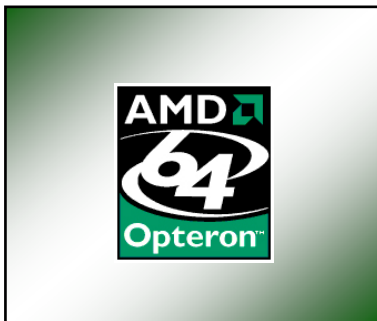
## AMD Opteron™ Processor 800 Series

- Industry-leading 32-bit performance and price/performance compared to Xeon MP
- Customer-friendly migration to 64-bit computing



## AMD Opteron Processor 200 Series

- Industry-leading 32-bit performance with unmatched 64-bit capability compared to Xeon 800 MHz FSB



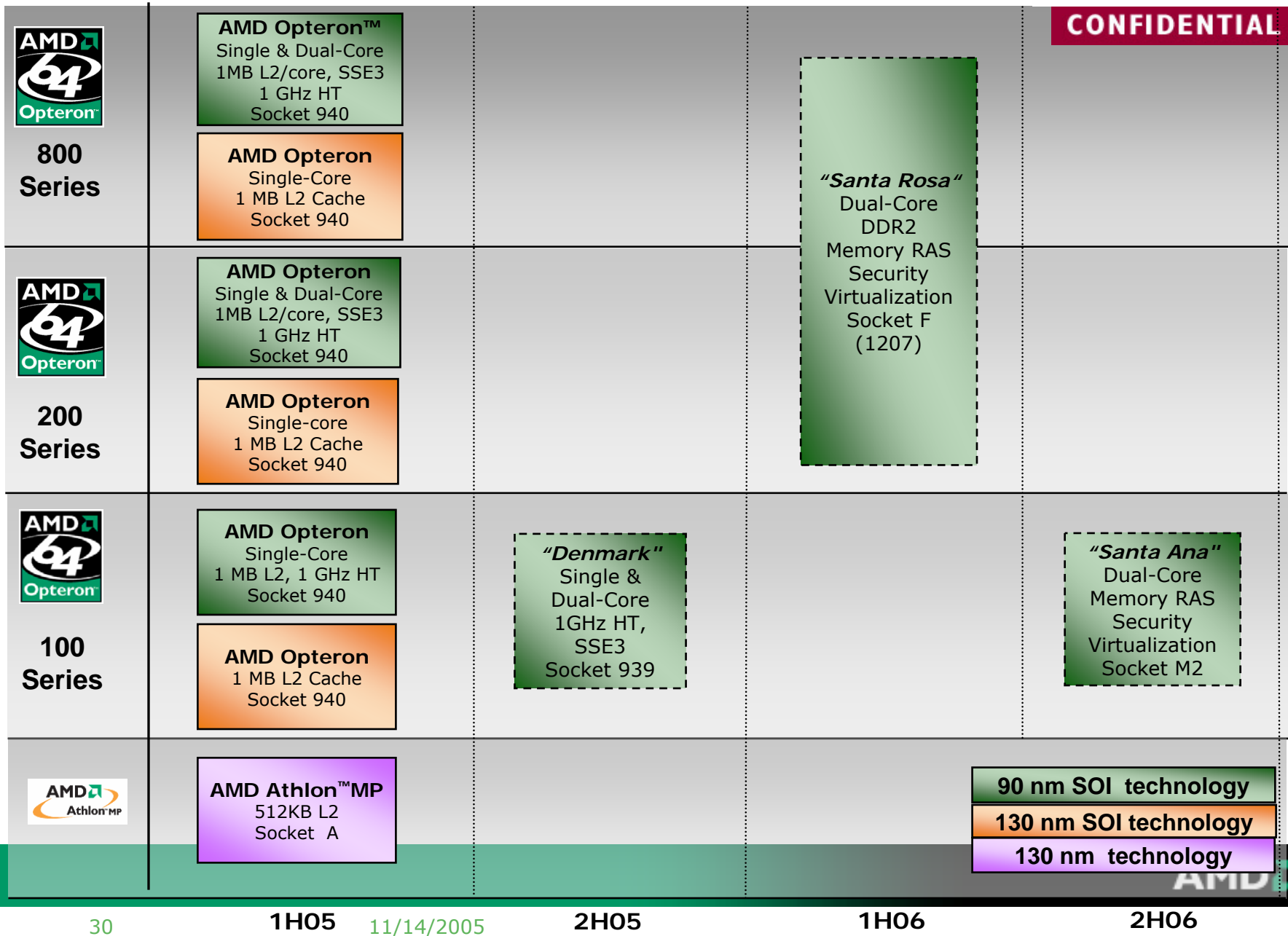
## AMD Opteron Processor 100 Series

- Industry-leading 32-bit performance with unmatched 64-bit capability compared to Pentium®4 800 MHz FSB

# AMD Server Processor Core Roadmap



**CONFIDENTIAL**



# AMD Software EcoSystem



# Broad-Based Software Support

## Compatibility is our first goal

- AMD64 dual-core technology is designed to be compatible with existing single-threaded and multi-threaded (hyper threaded) software
- For dual-core support the one piece of software that has to change is the BIOS

*Majority of ISVs do not have to redo any code*

*Most Server and Workstation Applications are Multithreaded Today!*



# Building the AMD64 Ecosystem

## The AMD64 Software Ecosystem Continues to Grow!

- Thousands of x86-based applications run today on AMD64 processors
- Over 300 ISVs and open source software organizations are actively promoting AMD64 compatibility
- AMD ecosystem efforts have focused on segment solution stacks
  - IT Infrastructure components
    - Server-Based Computing
    - Virtualization
    - Web and Application Servers
  - Vertical Applications
    - Scientific and Engineering
    - Business Processing

AMD64 Ecosystem Web Site CYQ2 2005 Statistics
Over 300 Development Organizations
Over 1,300 packages certified for AMD64 over 1,150 are shipping
120 operating system (versions) Includes Linux, Solaris, UNIX, Windows 52 are 64-bit (32 shipping)
307 Development Tools (versions) 115 are 64-bit (87 shipping)
52 Database Engines (versions) 19 are 64-bit (13 shipping)
385 Infrastructure Applications 101 are 64-bit (76 shipping)
470 Vertical Applications 171 are 64-bit (114 shipping)

# Building the AMD64 Ecosystem

**AMD is engaged with over 300 ISVs and IHVs to drive AMD64 support**



Computing

Solutions

**AMD64 Software Ecosystem Presentation:**

[www.amd.com/amd64ecosystem](http://www.amd.com/amd64ecosystem)

**AM64 Device Driver Information:**

[http://www.amd.com/us-en/Processors/DevelopWithAMD/0,,30\\_2252\\_875\\_10454,00.html](http://www.amd.com/us-en/Processors/DevelopWithAMD/0,,30_2252_875_10454,00.html)



Develop

with AMD

**AMD also provides support for the general software development community**

**AM64 Developer Home Page:**

[http://www.amd.com/us-en/Processors/DevelopWithAMD/0,,30\\_2252,00.html](http://www.amd.com/us-en/Processors/DevelopWithAMD/0,,30_2252,00.html)

**AM64 Dev Source (sponsored by AMD and DevX):**

[http://www.devx.com/amd/Door/16009?trk=Leftnav\\_FP\\_AMD](http://www.devx.com/amd/Door/16009?trk=Leftnav_FP_AMD)



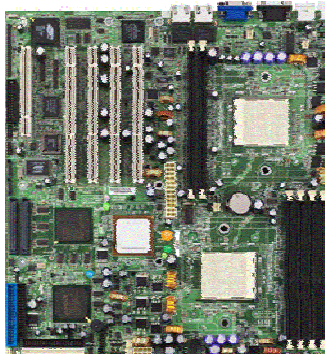
# **AMD Opteron™ Processor Hardware Infrastructure**



# AMD Opteron™ Processor Infrastructure Solutions

Build  
Your Own

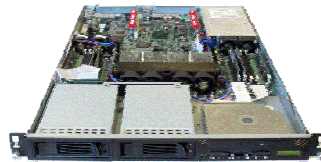
Fully  
Configured



Validated Server Program



NEWISYS™



IBM



TYAN  
WWW.TYAN.COM



RackSaver®  
Leader in High-Density Servers!

CRAY



ASUS®

Linux  
Network  
PROVEN

TATUNG  
SCIENCE & TECHNOLOGY, INC.

Rackable  
systems

APPR  
HPC Cluster Solutions

egenera®  
FUJITSU COMPUTERS  
SIEMENS

We make sure

acer

WWW.SUN.COM  
Sun  
microsystems



RIOWORKS™

BELL  
MICROPRODUCTS  
WHEN YOU NEED MORE

曙光  
DAWNING

hp  
invent



AMD

# AMD Opteron™ Processor - Tier 1 Server Platform Offerings




**Sun Fire V40z**

- ❑ 3U/4P, up to 32GB
- ❑ Redundant hot-swap power
- ❑ 6 drive bays
- ❑ LOM w/service processor



**Sun Fire V20z**

- ❑ 1U/2P, up to 32GB
- ❑ Up to 2 Ultra320 SCSI
- ❑ LOM





**Sun Fire x2100**

- ❑ 1U/1P, up to 4DIMMS
- ❑ Up to 2 SAS/SATA HS-HDD





**Sun Fire x4100**

- ❑ 1U/2P, up to 8DIMMS
- ❑ Up to 2 SAS/SATA HS-HDD
- ❑ Redundant HS P/S & fans; LOM




**Sun Fire x4200**

- ❑ 2U/2P, up to 8DIMMS
- ❑ Up to 4 SAS/SATA HS-HDD
- ❑ Redundant HS P/S & fans; LOM




**HP ProLiant DL585**

- ❑ 4U/4P
- ❑ Up to 64GB
- ❑ 4 drive bays
- ❑ Redundant power supplies




## HP ProLiant server blades

BL25p – 2P, 1GB to 2GB, 96 per rack

BL35p – 2P, 1GB to 2GB, 192 per rack

BL45p – 4P, 1GB to 2GB, xx per rack



## HP ProLiant DL385



- ❑ 2U/2P, up to 16GB memory
- ❑ SCSI Hot plug
- ❑ Optional redundant power supplies
- ❑ 6 drive bays



## HP ProLiant DL145

- ❑ 1U/2P, up to 16GB memory
- ❑ ATA-100 Non-Hot plug
- ❑ 2 drive bays



## IBM eServer 326



- ❑ 1U/2P, up to 16GB memory
- ❑ 2 Hot-plug Ultra320 SCSI



## LS20 for IBM eServer Blade Center

- ❑ 2P
- ❑ up to 8GB



# AMD Opteron™ Processor

## Tier 1 Workstation Platforms

FUJITSU COMPUTERS  
SIEMENS

We make sure

high-end  
workstation



Celsius V

<http://ddcwww/dep/dv/celsiusv.htm>



HP xw9300

*"Innovation is a critical part of our business as it expands the palette available to our artists. The introduction of the **HP xw9300 Workstation** represents a significant advancement in workstation technology that is sure to excite and enable our film makers in new and interesting ways."*

Ed Leonard, Chief Technology Officer, DreamWorks Animation SK



IBM IntelliStation A Pro 6224

IBM IntelliStation A Pro 6217

ULTIMATE 32-/64-BIT MULTIPROCESSOR PERFORMANCE



- #1 1P and 2P OCUS (Pro/ENGINEER)
- #1 2P Ensignt
- #1 1P SPECCompM 2001 (x86)

Sun Java Workstation W1100z & W2100z

<http://www.sun.com/desktop/workstation/w2100z/benchmarks.html>

Sun Java Workstation Ultra 20

<http://www.sun.com/desktop/workstation/ultra20/benchmarks.jsp>





# AMD Server Chipsets Product Line-Up

Server Chipset Product Line-Up

Single-Chip  
System-Logic

**nVIDIA**  
**nForce Professional 2200**  
•PCI-Express (20)  
•GbE, SATA (4), RAID  
•USB2 (10)  
•Southbridge

HT I/O  
Bridges &  
Tunnels

**Alliance Semi**  
SP1011  
HT-PCI-66  
Tunnel

**AMD-8131™**  
-Dual PCI-X® 133  
-APIC  
-HT 1.03 Tunnel

**AMD-8132™**  
-Dual PCI-X 266  
- APIC  
-HT 2.0 Tunnel

**ServerWorks**  
**HT-2000**  
- HT Tunnel  
-PCI-X 133,  
-PCI-Ex (17)  
-Dual GbE

HT  
Southbridges

**AMD-8111™**  
•ATA-133  
•USB2  
•LPC, PCI, APIC

**ULi 1563**  
•HT  
•ATA-133, USB2  
•LPC, PCI, APIC

**ServerWorks**  
**HT-1000**  
- HT  
- SATA (4)  
- PCI-X 133

Auxiliary  
Devices

**nVIDIA**  
**nForce Professional 2050**  
•PCI-Express™ (20)  
•GbE, SATA (4), RAID  
•USB2 (10)

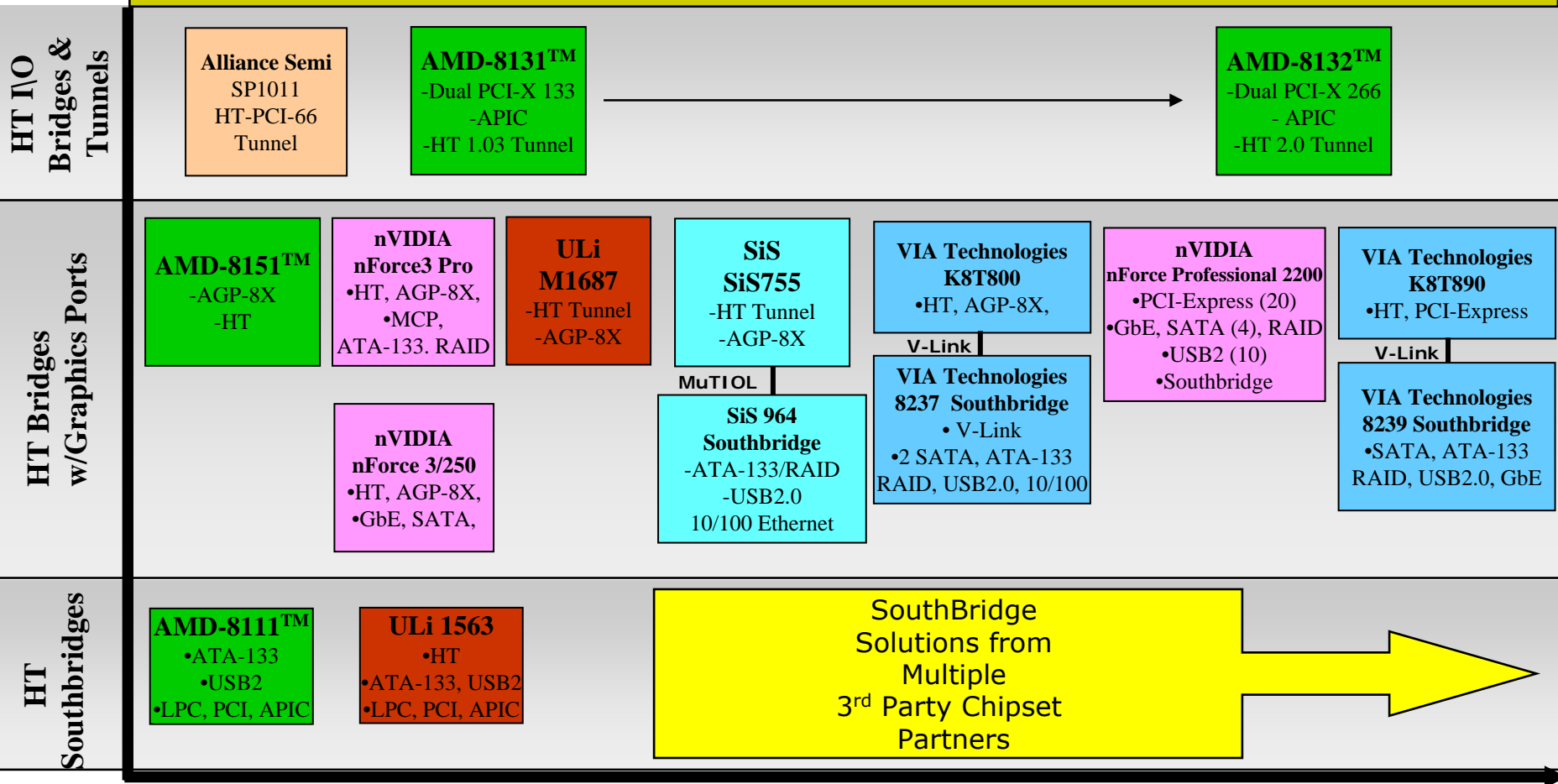
**ServerWorks**  
**Aragorn**  
- PCI-Ex (4)  
- SATA (8)  
- PCI-X 133

**ServerWorks**  
**Elrond**  
- PCI-Ex (4)  
- SAS (8)  
- PCI-X 133

----- Available in 2HCY'05

# AMD Workstation Chipsets Product Line-Up

Workstation Chipset Product Line-Up





# AMD Validated Server Program (VSP)

The Validated Server Program (VSP) represents a partnership between AMD and carefully selected solution providers to provide thoroughly tested high-quality, reliable & stable servers based on AMD Opteron™ processors. For more information on the AMD VSP Program visit :

[http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_13149,00.htm](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_13149,00.htm)

Validated Server Program Participants – Newisys is the first VSP participant who is a creative technology company dedicated to designing and delivering enterprise-class server and storage products. To view currently available Newisys 2-way and 4-way VSP servers visit:

[http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_13149^13152,00.html#2100-E](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_13149^13152,00.html#2100-E)

To order Newisys VSP servers on-line visit the URL below and click on “ Buy-Online”

[http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_13149^13152,00.html#2100-E](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_13149^13152,00.html#2100-E)

# Infrastructure Information

- We encourage our customers & partners to visit AMD's public website for infrastructure items including:

- System Component Information

- Recommended Motherboards
- Thermal Solution Guidelines
- Thermally Tested Server Solutions
- Memory Guidelines
- Power Supply Guidelines
- Tower Chassis Guidelines

[http://www.amd.com/us-en/Processors/TechnicalResources/0,,30\\_182\\_869\\_8819,00.html](http://www.amd.com/us-en/Processors/TechnicalResources/0,,30_182_869_8819,00.html)

- Open Platform Management Architecture (OPMA) specification

[http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_8796\\_12498,00.html](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_8796_12498,00.html)

- Support Components

<http://www.amd.com/configuration>

- Online Processor Quick Reference Guide

<http://www.amd.com/processorquickrefguide>

- AMD64 Ecosystem

[www.amd.com/amd64ecosystem](http://www.amd.com/amd64ecosystem)

- AMD Lead-Free Initiative

[http://www.amd.com/us-en/Processors/ProductInformation/0,,30\\_118\\_4040,00.html](http://www.amd.com/us-en/Processors/ProductInformation/0,,30_118_4040,00.html)

Thank You!

# Trademark Attribution

© 2005 Advanced Micro Devices, Inc. All rights reserved. AMD, the AMD Arrow logo, AMD Athlon, AMD Duron, AMD Opteron, AMD PowerNow!, AMD-8131, AMD-8111, AMD-8132, and AMD-8151, AMD-K6-2, and combinations thereof, are trademarks of Advanced Micro Devices, Inc. Microsoft and Windows are registered trademarks of Microsoft Corporation in the U.S. and/or other jurisdictions. Pentium is a registered trademark of Intel Corp. in the U.S. and/or other jurisdictions. HyperTransport is a licensed trademark of the HyperTransport Technology Consortium. Other names used in this presentation are for informational purposes only and may be trademarks of their respective owners.